

Infection Status of Endoparasites in Foreigner Workers Living in Cheonan City, Chungnam Province, Korea

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Abstract: At present, more than 500,000 foreigner workers, most of them from Asian countries with high parasitic infection rates, are working in Korea. Since investigation into the prevalence of parasitic infections in foreigner workers has not yet been conducted in Korea, the present study was performed to determine the parasitic infection status of foreigner workers living in Cheonan City, Chungcheongnam-do (Chungnam Province) and to plan, on that basis, effective control measures. From October to December 2013, the parasitic infection status of 231 foreigner workers employed at selected Cheonan-si small businesses was investigated by both stool examination and ELISA. A total of 60 individuals (26.0%) were found to be infected with parasites. The stool examination detected 14 positive cases (6.1%), and ELISA revealed 50 positive people (21.6%), for at least a kind of parasitic disease. The most common infection was cysticercosis (8.7%), followed by toxocariasis (7.8%) and clonorchiasis (7.4%). Since it was proved that parasitic infections were prevalent among foreigner workers living in Cheonan City, more comprehensive study is urgently needed in order to understand the nationwide status of parasitic infections in foreigner workers.

Key words: Foreigner worker, endoparasite, Cheonan City, parasitosis, stool, ELISA

In 2013, the number of foreigners working as factory laborers in Korea was approximately 500,000 [1]. Chinese was the most common nationality, accounting for almost a half (47.1%) of the total worker pool, followed by Vietnamese (12.1%), Indonesian (5.3%), Uzbekistani (4.6%), Thailander (4.1%), and Filipino (3.9%), among others [1]. These nations are still known as endemic areas of parasitic infections, for example, according to a recent survey conducted in Vietnam, 47% of the study population was positive for parasites such as *Ascaris lumbricoides* (24%), *Trichuris trichiura* (40%), and *Entamoeba histolytica* (6%) [2]. The prospective foreigner workers undergo a pre-employment medical examination; however, no screening test for parasitic infections is included. Most parasitic diseases are easily treatable after early diagnosis, but can cause severe complications if undetected and untreated, thereby negatively impact upon worker's productivity. Recently in

Korea, a 25-year-old Uzbek male complaining of abdominal pain was admitted to a hospital, and finally was diagnosed as cystic echinococcosis [3]. Since he had already been working for 3 years in his home country, early diagnosis through pre-employment medical examination certainly would have proved helpful for him and his industry, not to mention Korea. In advanced countries, unsurprisingly, screening of foreigner workers for parasitic infections is frequently carried out. In Japan, a dot-ELISA showed 28.4% to be positive for parasites, toxoplasmosis being the most common [4]. In Taiwan, a stool survey identified 7.4% of workers as positive, among whom the most common nationality was Vietnamese [5]. In Italy, the parasitic infection prevalence among immigrants between 2008 and 2009 was 61.9% [6]. However, no investigations of parasitic infection prevalence among foreigner workers have yet been conducted in Korea. The present study was conducted to determine the parasitic infections of foreigner workers living in Cheonan-si (City), Chungcheongnam-do (Province) and at the same time to lay the initial groundwork for future infection-control measures.

With the help of the Cheonan Support Center for Foreigner Workers, small businesses employing foreigner workers in

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Cheonan-si were selected from October to December, 2013. A total of 231 foreigner workers, 218 males and 13 females, provided samples. Among the 11 nationalities represented, the most common was Nepalese (33.8%), followed by Chinese, Indonesian, Uzbekistani, Vietnamese, and the rest. The study subjects ranged in age from 20s to 50s, most of them being in their 20s (42.0%) and 30s (36.4%). After informing the workers of the significance and necessity of this research, they were asked to provide a single fecal sample and to bring it at their workplace on the scheduled day. On that same day, blood sampling was performed and relevant personal information was obtained. The fecal samples were transferred to a laboratory where they were subjected to processing by both the Kato-Katz thick smear technique and formalin-ether concentration technique preparatory to microscopic examinations.

Each blood sample was centrifuged and stored refrigerated in the laboratory prior to ELISA testing for parasitic infections. ELISA was performed in the laboratory of the Institute of Endemic Diseases, Seoul National University College of Medicine, targeting *Clonorchis sinensis*, *Paragonimus westermani*, metacestode of *Taenia solium* (*Cysticercus cellulosae*), sparganum, *Toxocara canis*, and *Echinococcus granulosus*. The employed antigens of these helminths included crude extracts of *C. sinensis* and *P. westermani*, cystic fluid of *T. solium* metacestode, crude saline extract of spargana, and excretory-secretory antigen of *Toxocara canis* larvae. The utilized sera, both negative and positive controls were collected, respectively, from healthy students and single-antibody-positive patients who had been diagnosed previously by routine ELISA. The positive criteria of ELISA absorbance were 0.250 in clonorchiasis, 0.280 in paragonimiasis, 0.290 in cysticercosis, 0.240 in sparganosis, 0.250 in toxocariasis, and 0.270 in echinococcosis, all of which were calculated from raw empirical data.

As indicated in Table 1, a total of 60 foreigner workers from 11 countries were found to be infected with parasites; the overall infection rate was 26.0% (60/231). The stool examination detected 14 positive cases (6.1%), 2 of which showed concurrent infections with 2 kinds of parasites. Hookworms and *Trichostrongylus orientalis* eggs were observed in 3 cases each, and those of *C. sinensis* and *T. trichiura* in 2 cases each (Table 1). Protozoan cysts were also detected, those of *Giardia lamblia*, found in 3 workers, being the most common species. Cysts of *Entamoeba coli*, *Endolimax nana*, and *Entamoeba histolytica* or *E. dispar* were discovered as well (Table 1). Most of the positive cases were detected by serological examinations. In ELISA, 50

Table 1. Positive rate of parasites in fecal and serological examinations by their countries

Country	Stool positivities (%)	Serum positivities (%)	Total (%)
Nepal	7/78 (8.8)	16/78 (20.5) ^a	20/78 (25.6)
China	1/43 (2.3)	8/43 (18.6)	9/43 (20.9)
Indonesia	3/27 (11.1)	5/27 (18.5)	8/27 (29.6)
Uzbekistan	1/22 (4.6)	3/22 (13.6) ^b	3/22 (13.6)
Vietnam	1/18 (5.6)	5/18 (27.8)	6/18 (33.3)
Thailand	1/16 (6.3)	2/16 (12.5)	3/16 (18.8)
Sri Lanka	0	4/9 (44.4)	4/9 (44.4)
Kazakhstan	0	4/6 (66.7)	4/6 (66.7)
Philippines	0	1/4 (25)	1/4 (25)
Cambodia	0	1/5 (20)	1/5 (20)
Myanmar	0	1/3 (33.3)	1/3 (33.3)
Total	14/231 (6.1)	50/231 (21.6)	60/231 (26.0)

^aThree workers were concurrently positive to both stool examination and ELISA.

^bOne worker was concurrently positive to both stool examination and ELISA.

(21.6%) of the 231 workers were positive for at least 1 kind of parasitic disease. The most common infection was cysticercosis (8.7%), followed by toxocariasis (7.8%), clonorchiasis (7.4%), and echinococcosis (3.5%). Paragonimiasis was detected only in 2 workers (Table 1). Among the 11 nationalities represented in this study, the highest numbers of positive cases were detected in Nepalese (20), Chinese (9), and Indonesian (8) workers, though the highest infection rate was found among Sri Lankan workers (44.4%) (Table 2). All the workers tested positive by stool examinations were provided the anthelmintic drugs such as albendazole (400 mg, once) and praziquantel (40 mg/kg, once). Those showing protozoa or serum antibody positive cases, meanwhile, were directed to health screening centers where they could be treated for parasites.

The summary judgment of this study was that parasitic infections were prevalent among foreigner workers living in Cheonan-si, Chungcheongnam-do. The overall infection rate, based on both serological and stool examinations, was 26.0%, much higher than that reported for the general Korean population, 2.6%, in 2012 [7]. Although this Korean rate had been calculated by stool examination only, it is still less than half of the present study's stool positivity rate, 6.1%. This was similar to the stool positivity of foreigner workers in Taiwan, 7.4% [5]. As for the serum antibody positive rate in the present study, 21.6%, it was slightly lower than that of the foreigner workers in Japan, 28.4% [4,5]. Particularly, given that most parasitic diseases are easily treated with anthelmintic drugs, screening

Table 2. Number of positive workers for each helminth or protozoa detected either by stool examination or ELISA

Parasite	No. of stool positive cases according to country	No. of serum positive cases according to country	Total positive cases (%)
<i>Trichuris trichiura</i>	Indonesia 1, Nepal 1	-	2/231 (0.9)
<i>Trichostrongylus orientalis</i>	Indonesia 1, Nepal 1, Vietnam 1	-	3/231 (1.3)
Hookworms	Nepal 3	-	3/231 (1.3)
<i>Clonorchis sinensis</i>	Uzbek 1	China 6, Indonesia 3, Uzbek 2, Thailand 1, Kazak 1, Vietnam 2, Philippines 1, Nepal 1	18/231 (7.8)
<i>Toxocara canis</i>	-	Nepal 7, Vietnam 3, China 2, Kazak 2, Indonesia 2, Thailand 1, Sri Lanka 1	18/231 (7.8)
<i>Paragonimus westermani</i>	-	China 1	1/231 (0.4)
<i>Echinococcus granulosus</i>	-	Nepal 5, Myanmar 1, Cambodia 1, Indonesia 1	8/231 (3.5)
<i>Cysticercus cellulosae</i> (<i>Taenia solium</i> metacestode)	-	Nepal 8, Sri Lanka 3, Kazak 3, Indonesia 3, Vietnam 1, China 1, Uzbek 1	20/231 (8.7)
Sparganum	-	Sri Lanka 1	1/231 (0.4)
<i>Giardia lamblia</i>	Nepal 1, Uzbek 1	-	2/231 (0.9)
<i>Entamoeba histolytica</i> or <i>E. dispar</i>	Nepal 1	-	1/231 (0.4)
<i>Entamoeba coli</i>	Indonesia 1	-	1/231 (0.4)
<i>Endolimax nana</i>	China 1	-	1/231 (0.4)
Total			60/231 (26.0)

for parasitic infections among foreigner workers is needed in order to ensure early diagnosis and treatment.

The prevalence rate of *C. sinensis* in our study was 7.4%. However, eggs were recovered from only 1 stool sample of an Uzbekistani, where *C. sinensis* is not distributed [8]. Except for Chinese and Vietnamese, the seropositive cases were those from non-endemic areas of clonorchiasis [8]. In this regard, they might be infected with *C. sinensis* after their immigration to Korea. Another possible explanation is related to the present study's use of a crude extract antigen in ELISA test, which reduced the sensitivity and specificity to 88.2% and 87.8%, respectively [9]. Considering that the serum of the stool positive patients was not reacted to *C. sinensis* antigen in this study, it was speculated that there could be more false negativities in this population.

Protozoan cysts such as *G. lamblia*, *E. coli*, *E. nana*, and another *Entamoeba* sp., were discovered in the present study. Although *E. coli* and *E. nana* have been known to be non-pathogenic, the foreigner workers infected with *Entamoeba* sp. and *G. lamblia* were symptom-free. This phenomenon might be better understood in light of the fact that giardiasis is symptomatic only about 50%, and that the *Entamoeba* sp. in the present case may be *E. dispar*, the known gut commensal [10,11].

The most common parasitic infection encountered in this

study was cysticercosis (8.7%), and nearly a half (40%) of the cases was among Nepalese workers. According to a previous report from Nepal, the positive rate for *T. solium* ranged from 10% to 50% in some districts, and for porcine cysticercosis, 32.5% [12]. In the present study, seropositive cases for cysticercosis were also found in workers from Sri Lanka, Kazakhstan, Indonesia, China, and Vietnam, and in the latter 3 countries, the presence of cysticercosis was confirmed [12]. It was also noteworthy that 8 workers (3.5%), mostly Nepalese (5 individuals), tested serologically positive for hydatid disease. Even though indigenous cases have been reported in Korea, it is probable that the foreigner workers tested in the present study had been infected with hydatid disease in their homelands [13]. In fact, Nepal is an endemic country for hydatid disease which involves the breast [14]. Further work-up on these patients is urgently required, especially in consideration of the fact that hydatid disease can lead to medical emergencies such as in the case of an Uzbek worker [3] noted earlier in this paper.

Notwithstanding the sharply decreasing tendencies in the Korean rates of parasitic infections, rates remain high in some other Asian countries. Laborers of those nationalities working in Korea might suffer from parasitoses during their stay, or, still more seriously, could unwittingly facilitate the comeback of parasites that had already been eradicated from Korea. There-

fore, their infection status should be checked carefully, not only to protect those workers in the short term but also to establish and build the kinds of database that will be essential to any future Korean parasite-control programs. The present study can be considered to be inaugural in both respects, but has a limitation that the foreigner workers only in Cheonan-si were selected for parasitological examinations. At present, a large number of foreigner workers have been working in various areas such as Gyonggi-do, Seoul, Gyongsangnam-do, and Incheon. Hence, more comprehensive study on those areas is urgently needed in order to understand the parasitic infections of foreigner workers in Korea.

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CONFLICT OF INTEREST

We have no conflict of interest related to this work.

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